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Benton et al.

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(54) **SEPARATION SYSTEMS, ELEMENTS, AND METHODS FOR SEPARATION UTILIZING STACKED MEMBRANES AND SPACERS**

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See application file for complete search history.

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(57) **ABSTRACT**

An example separation system includes a stack of membrane plate assemblies. An example membrane plate assembly may include membranes bonded to opposite sides of a spacer plate. The spacer plate may include a first opening in fluid communication with a region between the membranes, and a second opening in fluid communication with a region between membrane plate assemblies. Adjacent membrane plate assemblies in the stack may have alternating orientations such that bonding areas for adjacent membranes in the stack may be staggered. Accordingly, two isolated flows may be provided which may be orthogonal from one another.

23 Claims, 24 Drawing Sheets

